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**Baba**

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(54) **POWER SUPPLY CONTROL APPARATUS,  
IMAGE PROCESSING APPARATUS,  
NON-TRANSITORY COMPUTER READABLE  
MEDIUM, AND POWER SUPPLY CONTROL  
METHOD**

(71) Applicant: **FUJI XEROX CO., LTD.**, Minato-ku,  
Tokyo (JP)

(72) Inventor: **Motofumi Baba**, Kanagawa (JP)

(73) Assignee: **FUJI XEROX CO., LTD.**, Tokyo (JP)

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(58) **Field of Classification Search**

None

See application file for complete search history.

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*Primary Examiner* — King Poon

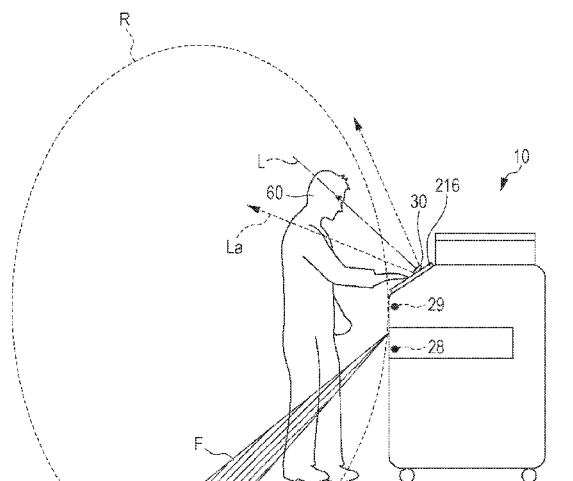
*Assistant Examiner* — Ted Barnes

(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

A power supply control apparatus includes a transition unit, a  
detector, a first image capturing unit, a command unit, a  
second image capturing unit, and an identity recognition unit.  
The transition unit makes a control target enter a power sup-  
ply state or a power shutoff state. The detector detects a  
moving object while the control target is in the power shutoff  
state. The first image capturing unit captures images of a  
specific area at the time when the detector detects a moving  
object. The command unit commands the transition unit to  
make the control target enter the power supply state in a case  
where it is determined that the moving object is approaching  
the control target. The second image capturing unit captures a  
characteristic image of the moving object that is approaching  
the control target. The identity recognition unit performs  
identity recognition in accordance with the characteristic  
image.

**6 Claims, 13 Drawing Sheets**



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FIG. 1

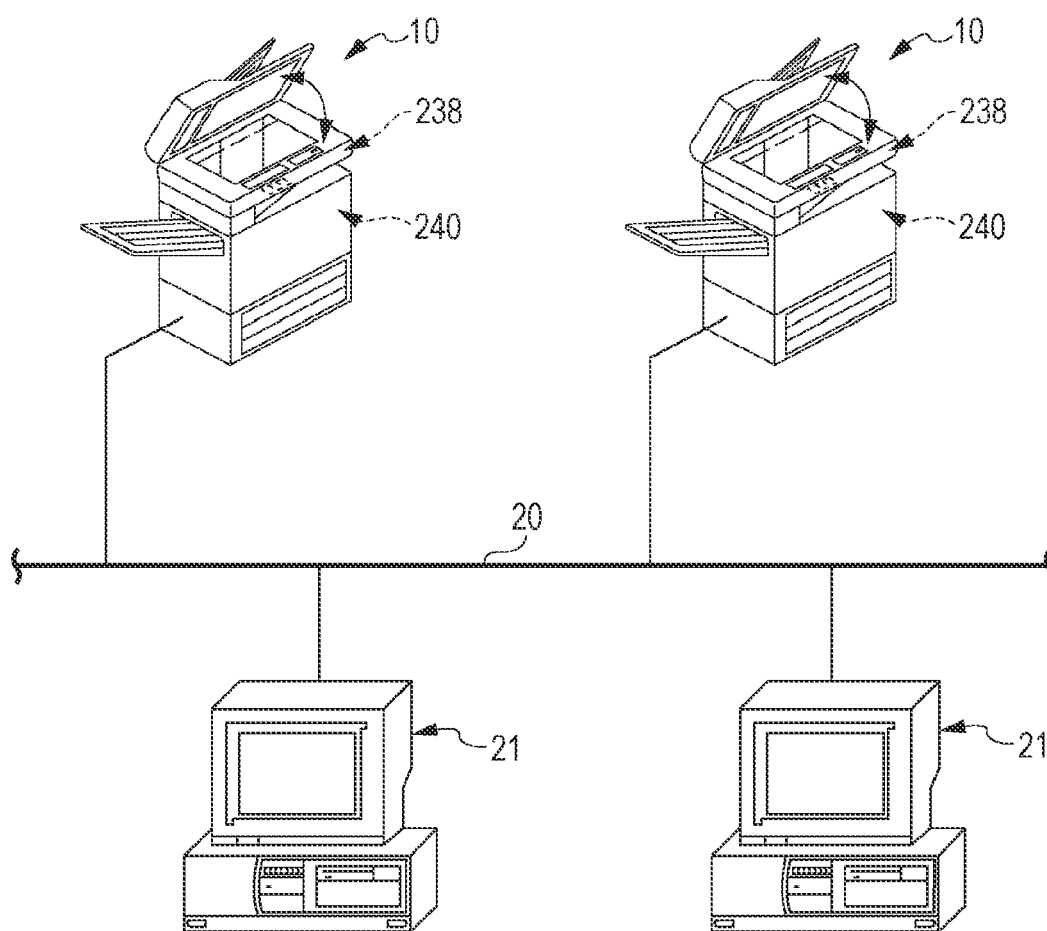


FIG. 2

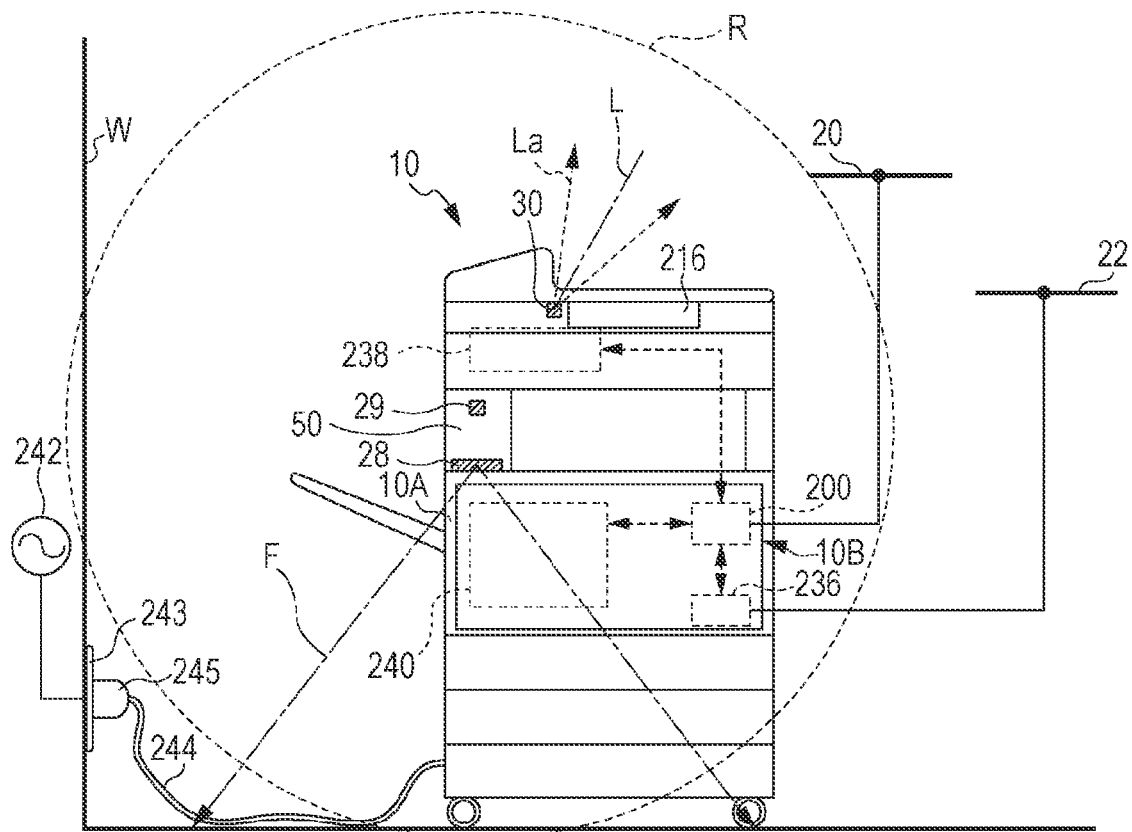
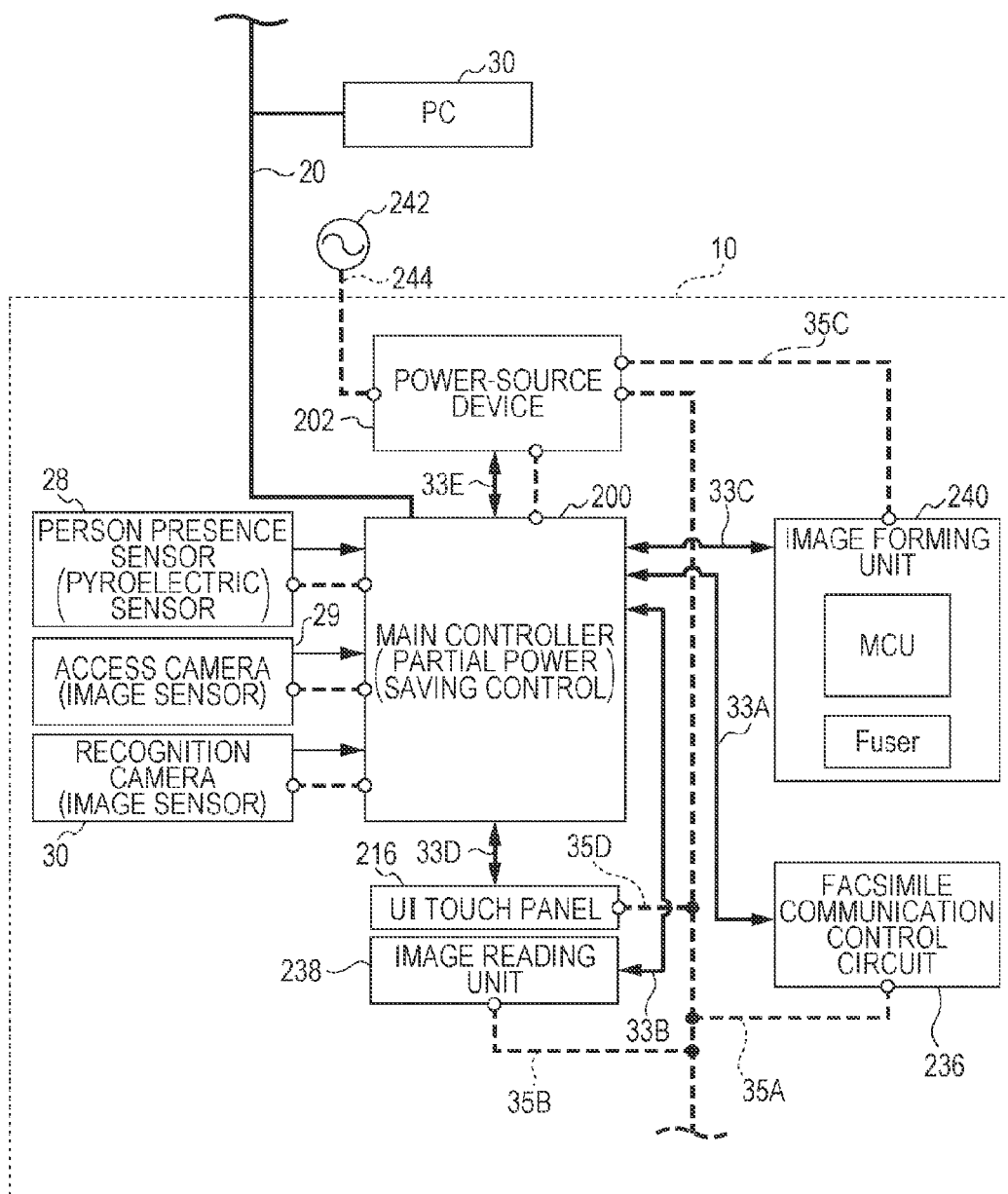


FIG. 3



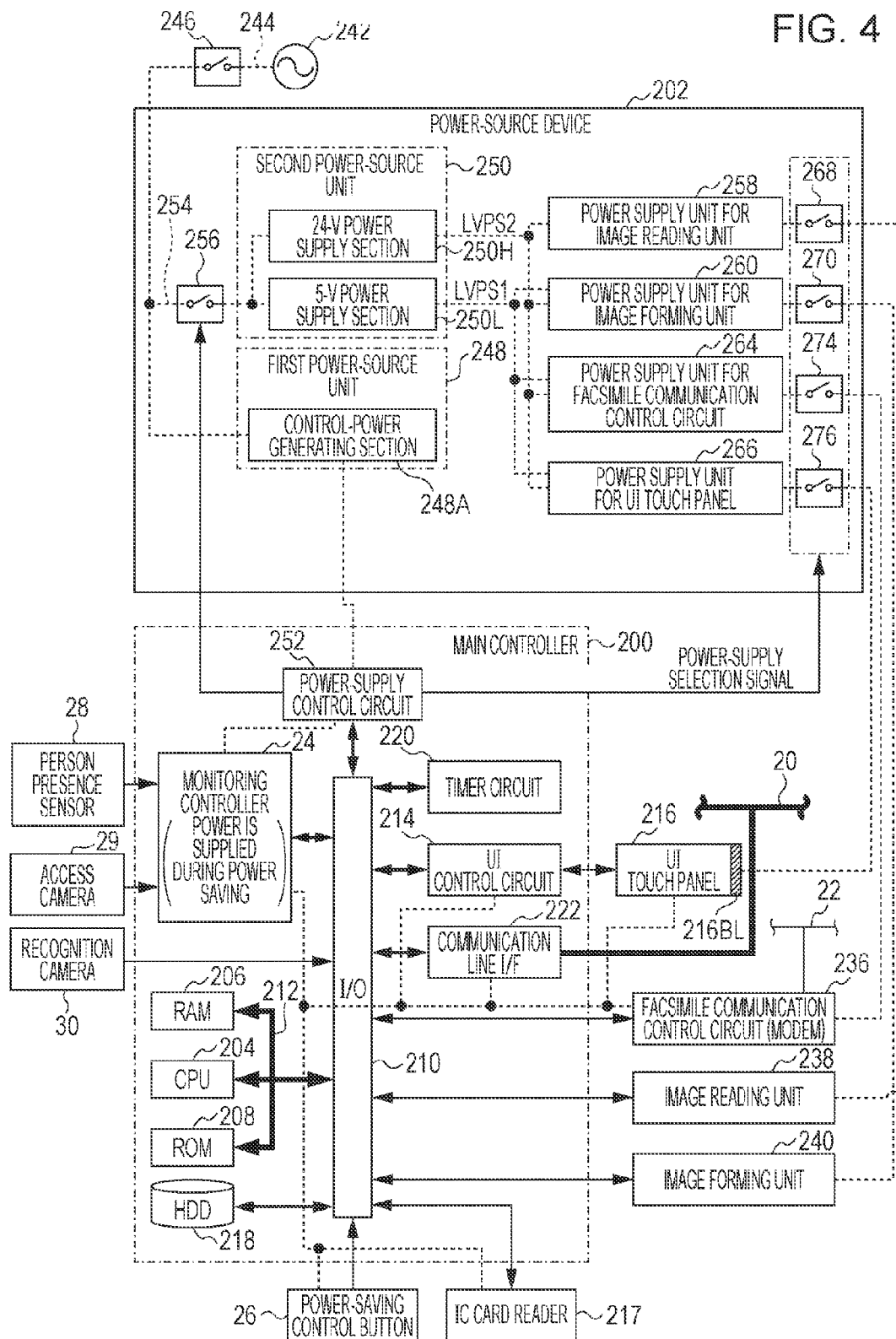


FIG. 5

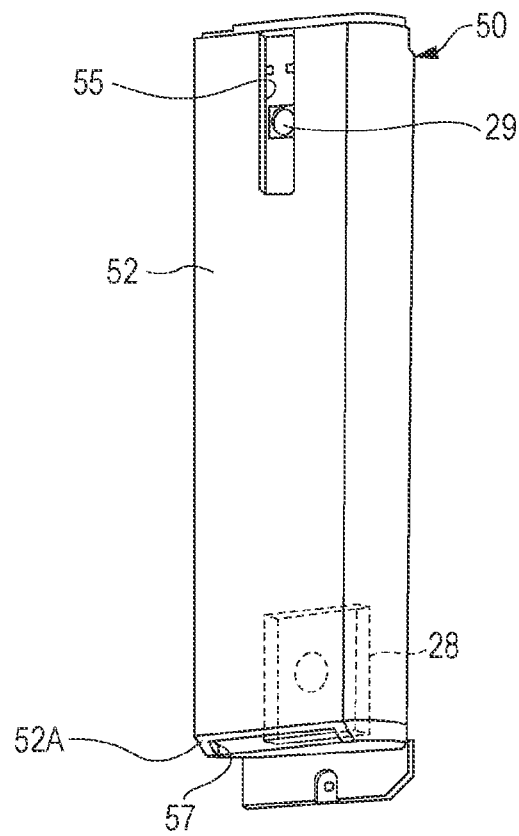


FIG. 6

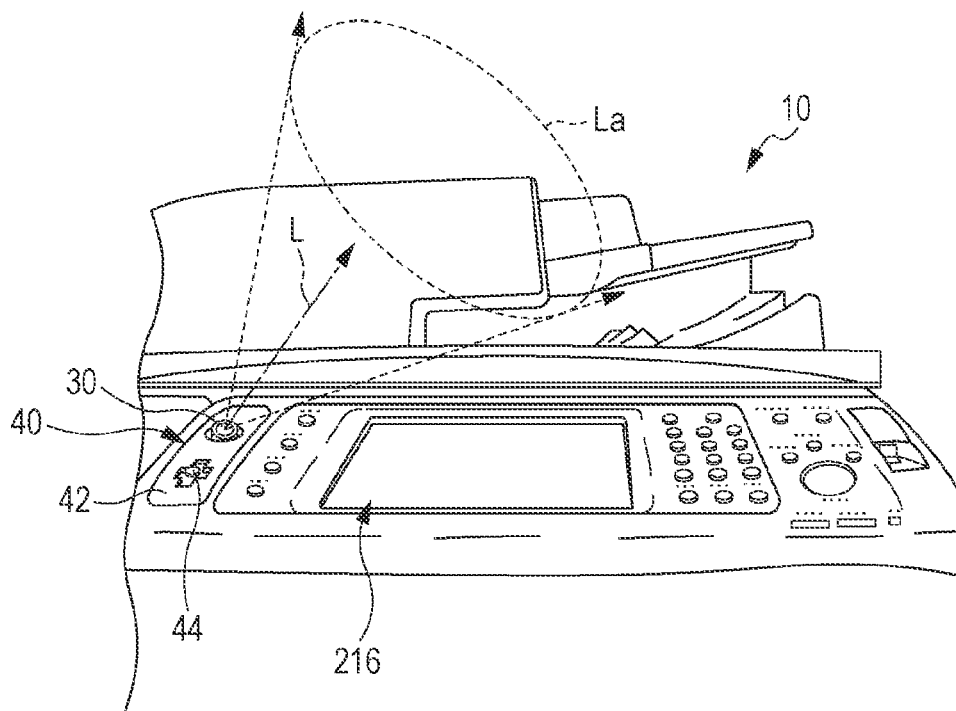




FIG. 7

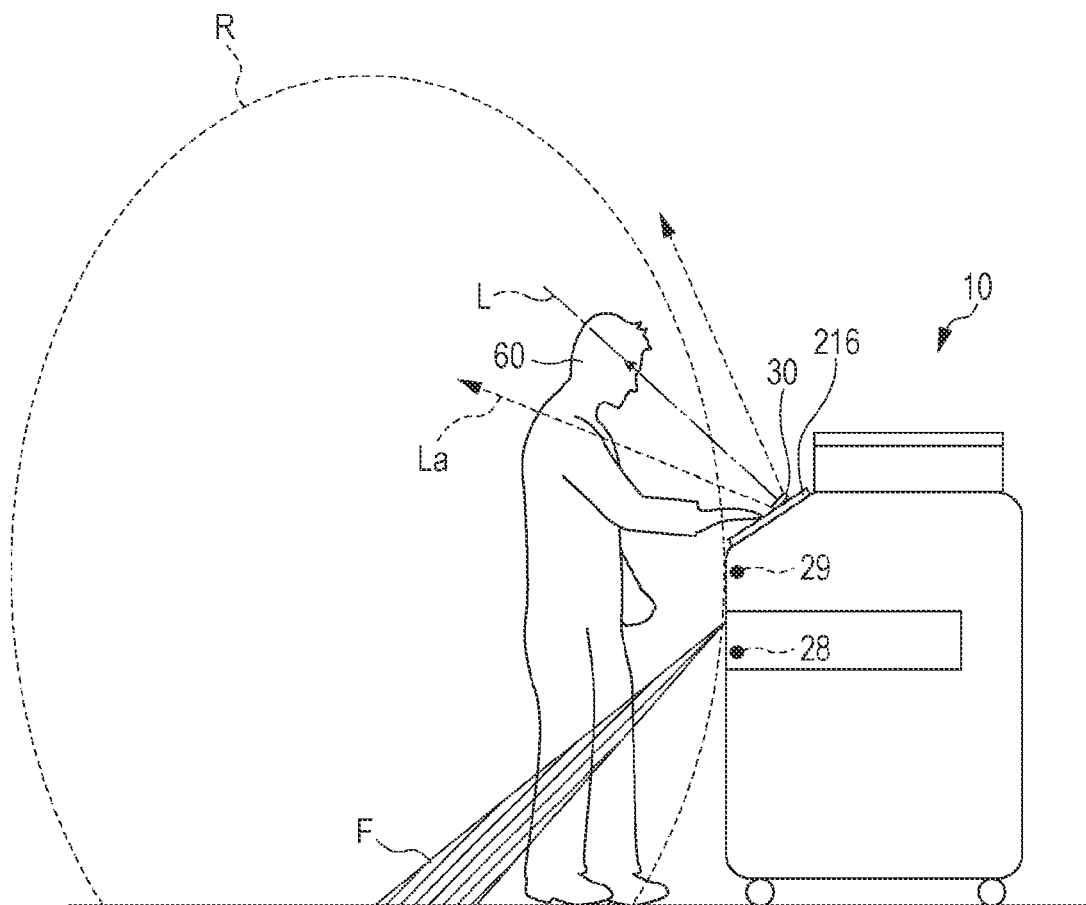


FIG. 8

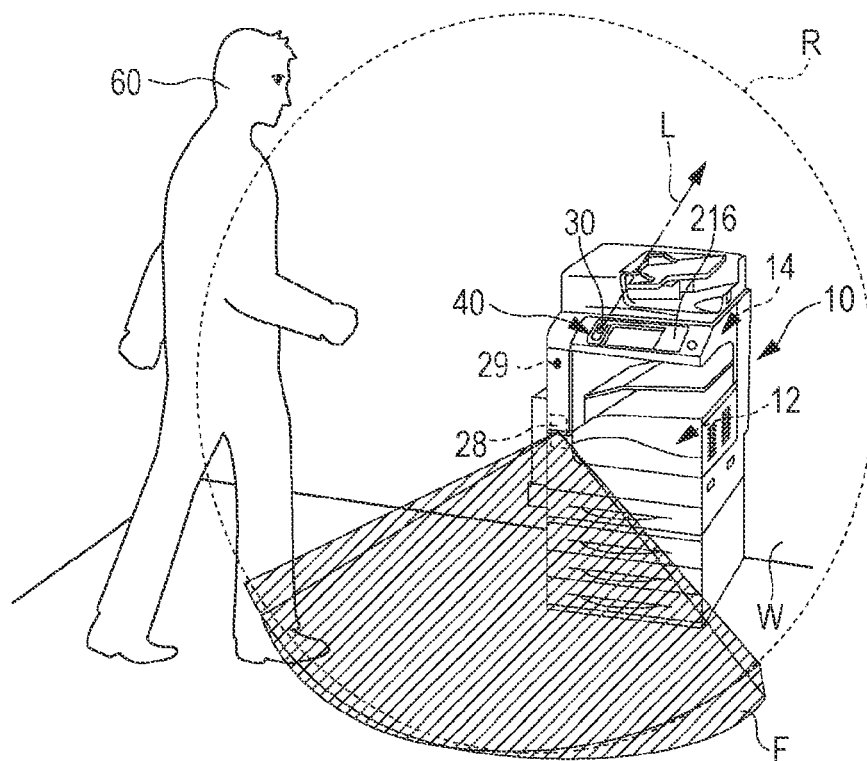


FIG. 9

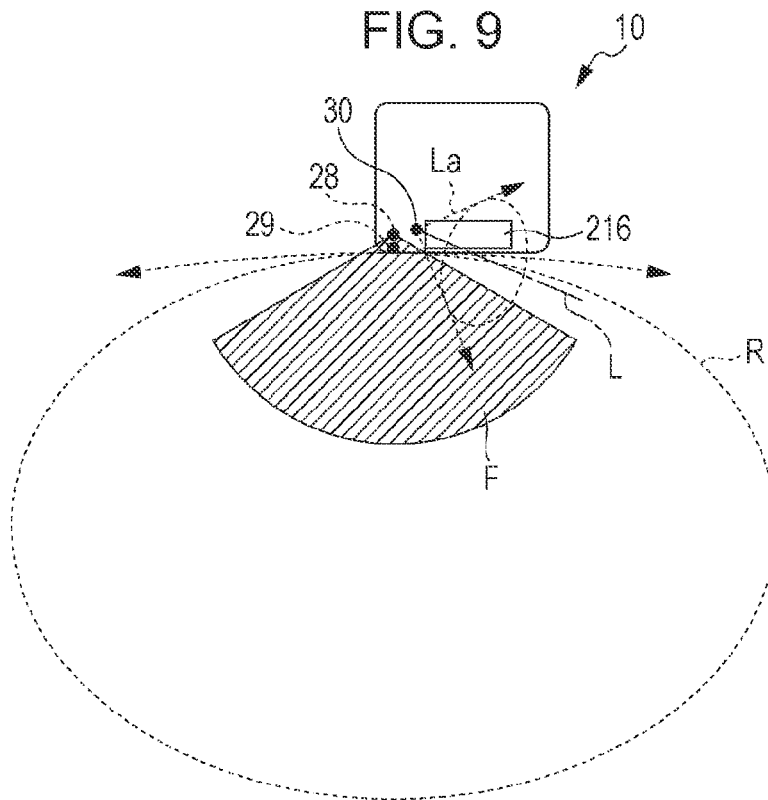


FIG. 10

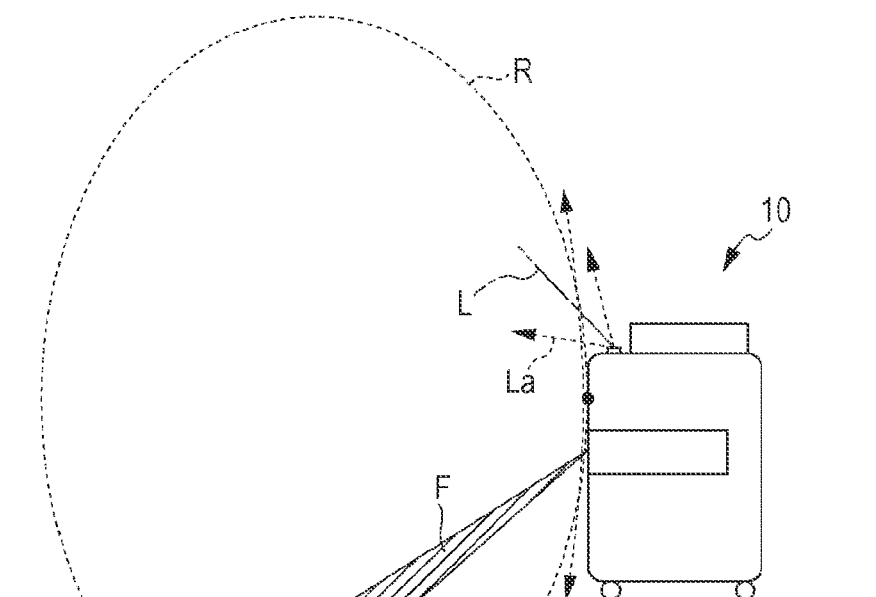


FIG. 11

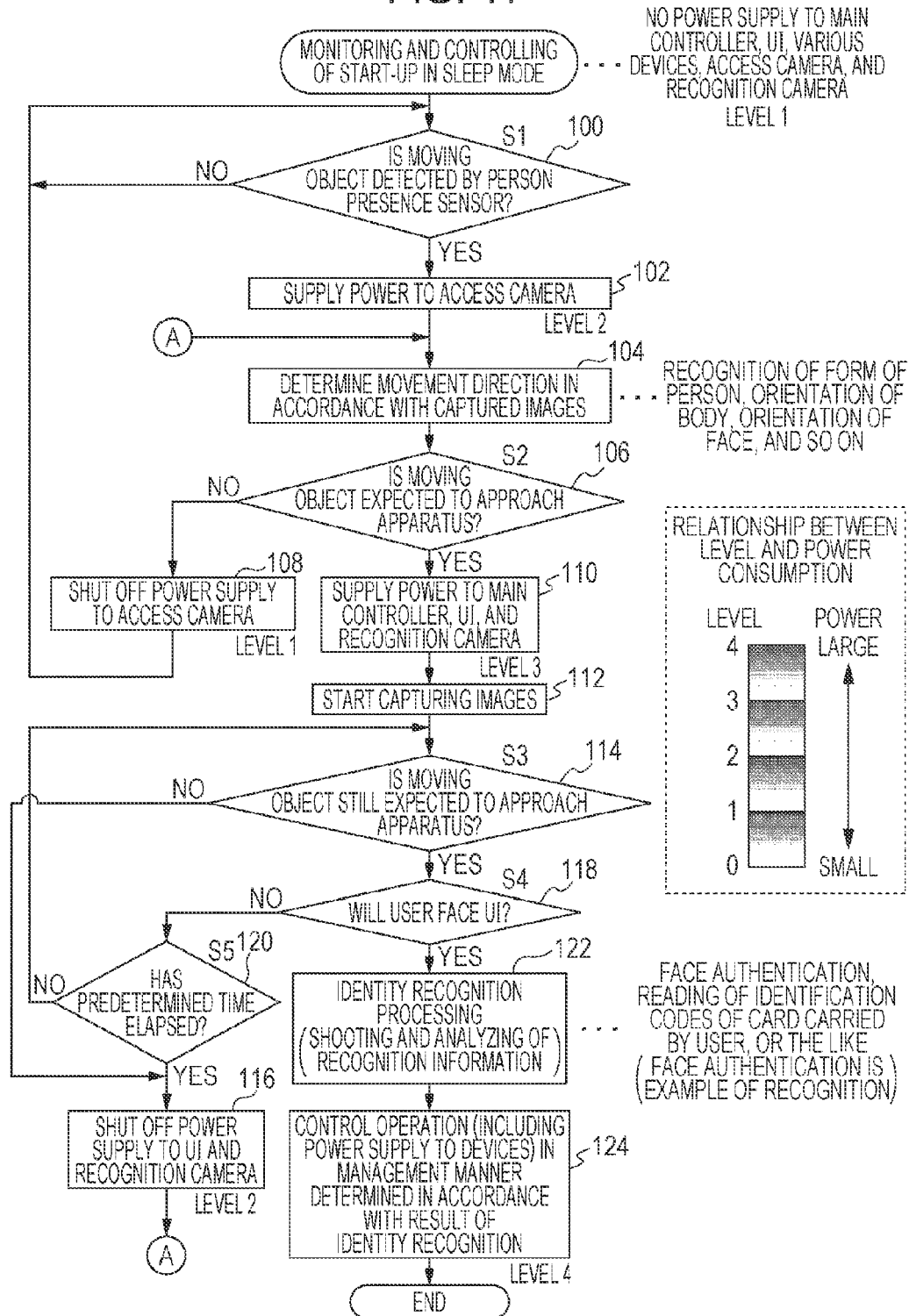


FIG. 12A

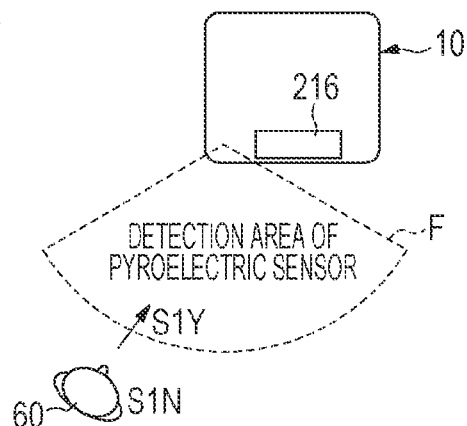


FIG. 12B

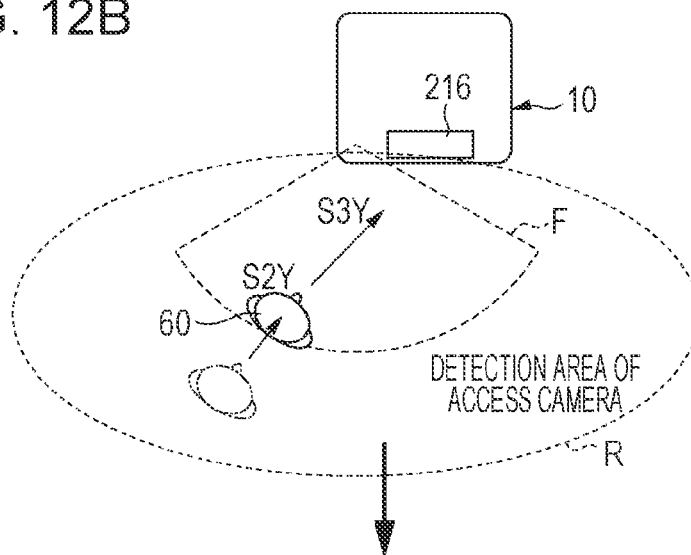


FIG. 12C

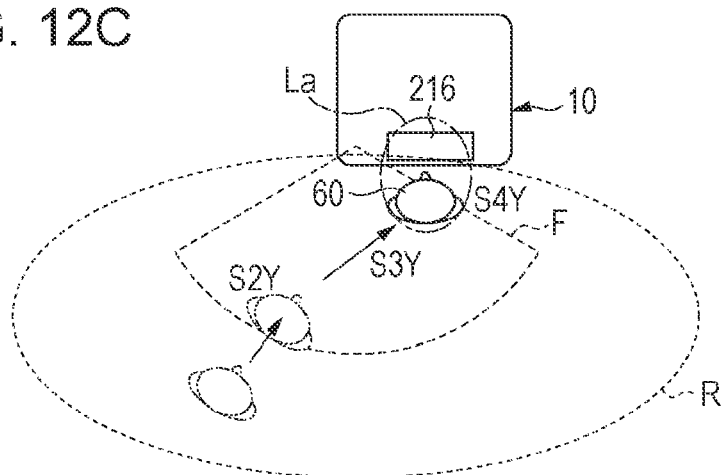


FIG. 13A

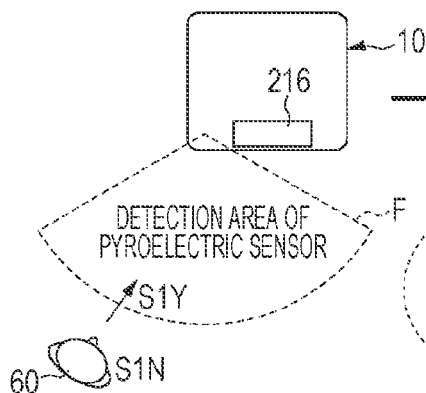


FIG. 13B

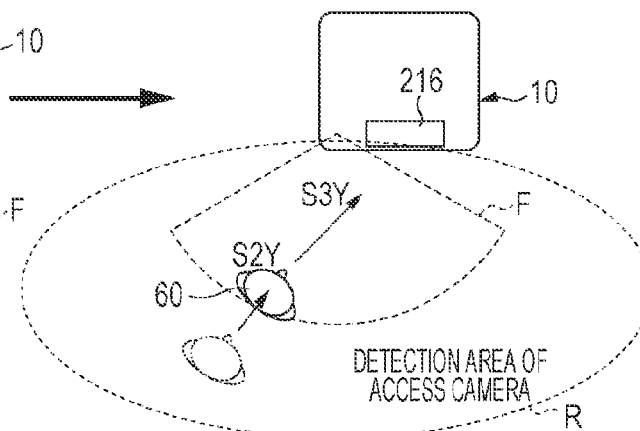


FIG. 13C

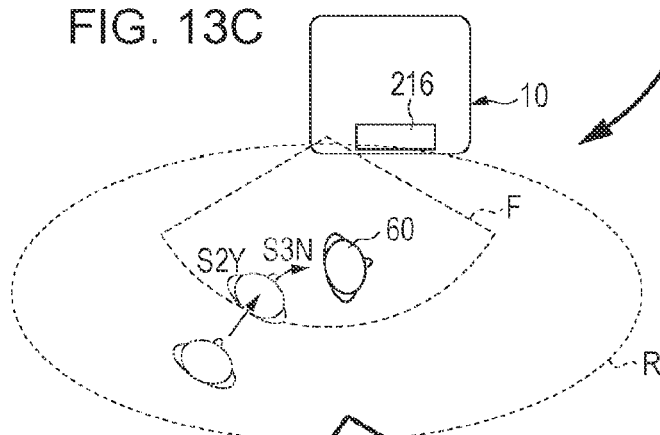


FIG. 13D

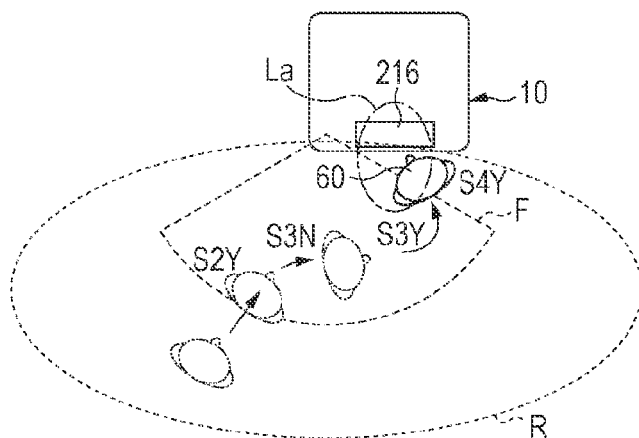


FIG. 13E

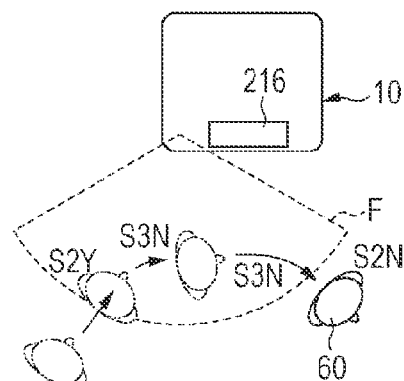


FIG. 14A

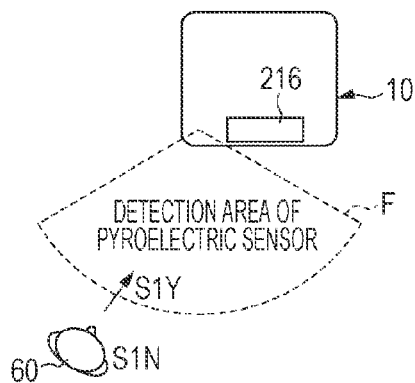


FIG. 14B

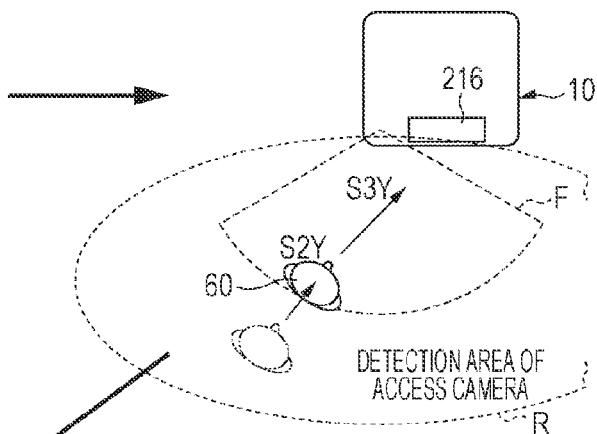


FIG. 14C

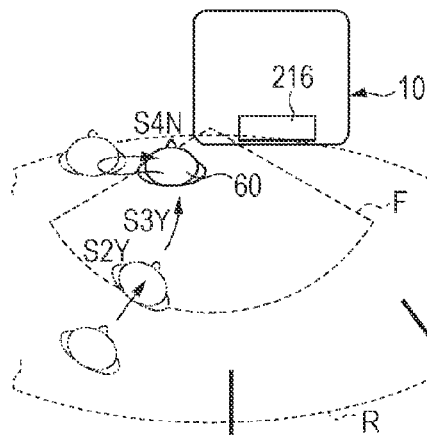


FIG. 14D

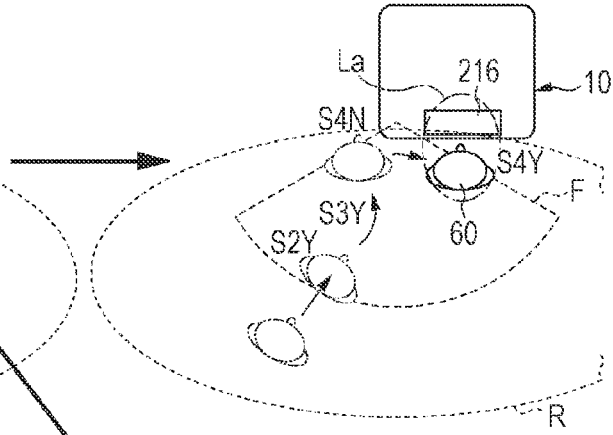


FIG. 14E

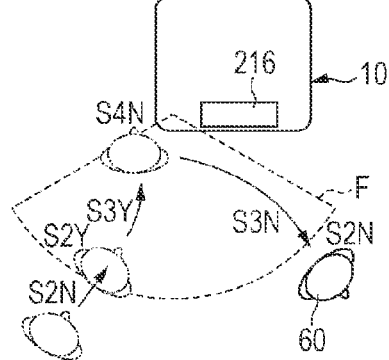
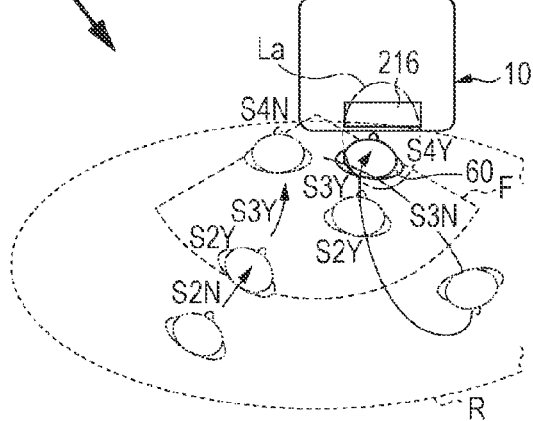


FIG. 14F



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**POWER SUPPLY CONTROL APPARATUS,  
IMAGE PROCESSING APPARATUS,  
NON-TRANSITORY COMPUTER READABLE  
MEDIUM, AND POWER SUPPLY CONTROL  
METHOD**

**CROSS-REFERENCE TO RELATED  
APPLICATIONS**

This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2012-228343 filed Oct. 15, 2012.

**BACKGROUND**

(i) Technical Field

The present invention relates to a power supply control apparatus, an image processing apparatus, a non-transitory computer readable medium, and a power supply control method.

(ii) Related Art

Person presence sensor control is a way to automate power supply saving control for devices that are power supply targets.

**SUMMARY**

According to an aspect of the invention, there is provided a power supply control apparatus including a transition unit, a detector, a first image capturing unit, a command unit, a second image capturing unit, and an identity recognition unit. The transition unit makes a control target that includes processing units enter a power supply state or a power shutoff state, power being selectively supplied to the processing units in the power supply state. The detector detects a moving object while the control target is in the power shutoff state. The first image capturing unit captures images of a specific area at the time when the detector detects a moving object. The command unit commands the transition unit to make the control target enter the power supply state in a case where it is determined that the moving object is approaching the control target in accordance with image information of the images captured by the first image capturing unit. The second image capturing unit captures a characteristic image of the moving object that is approaching the control target. The identity recognition unit performs identity recognition for the moving object in accordance with image information of the characteristic image captured by the second image capturing unit.

**BRIEF DESCRIPTION OF THE DRAWINGS**

An exemplary embodiment of the present invention will be described in detail based on the following figures, wherein:

FIG. 1 is a diagram illustrating connection in a communication line network that includes image processing apparatuses according to a present exemplary embodiment;

FIG. 2 is a schematic diagram of an image processing apparatus according to the present exemplary embodiment;

FIG. 3 is a block diagram of the structure of a control system of the image processing apparatus according to the present exemplary embodiment;

FIG. 4 is a schematic diagram illustrating a functional structure of a control system that includes a main controller and a power-source device according to the present exemplary embodiment;

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FIG. 5 is a perspective view of a covering member provided on the front surface of a pillar unit according to the present exemplary embodiment;

FIG. 6 is an external view illustrating a user interface (UI) touch panel according to the present exemplary embodiment;

FIG. 7 is a side view illustrating a case where a user is facing the UI touch panel, according to the present exemplary embodiment;

FIG. 8 is a perspective view illustrating a state in which a user is approaching the image processing apparatus according to the present exemplary embodiment;

FIG. 9 is a plan view of the image processing apparatus, the plan view illustrating a detection area of a person presence sensor, a detection area of an access camera, and a detection area of a recognition camera according to the present exemplary embodiment;

FIG. 10 is a side view of the image processing apparatus, the side view illustrating the detection area of the person presence sensor, the detection area of the access camera, and the detection area of the recognition camera according to the present exemplary embodiment;

FIG. 11 is a flowchart illustrating a routine for monitoring and controlling start-up in a sleep mode according to the present exemplary embodiment;

FIGS. 12A to 12C are plan views of the image processing apparatus, the plan views illustrating a first action flow according to the flowchart of FIG. 11;

FIGS. 13A to 13E are plan views of the image processing apparatus, the plan views illustrating a second action flow according to the flowchart of FIG. 11; and

FIGS. 14A to 14F are plan views of the image processing apparatus, the plan views illustrating a third action flow according to the flowchart of FIG. 11.

**DETAILED DESCRIPTION**

As illustrated in FIG. 1, an image processing apparatus 10 according to the present exemplary embodiment is connected to a network-communication network 20 such as the Internet. In FIG. 1, two image processing apparatuses 10 are connected to the network-communication network 20; however, the number of image processing apparatuses 10 is not limited thereto, and may be one or be three or more.

Moreover, plural personal computers (PC) 21 functioning as information terminal devices are connected to the network-communication network 20. In FIG. 1, two PCs 21 are connected to the network-communication network 20; however, the number of PCs 21 is not limited thereto, and may be one or be three or more. Moreover, the information terminal devices are not limited to the PCs 21. Additionally, wired connection does not necessarily need to be used for the network-communication network 20. In other words, the network-communication network 20 may be a communication network in which information is partially or entirely transmitted and received using wireless connection.

As illustrated in FIG. 1, for each of the image processing apparatuses 10, there is a case in which, for example, data is transferred from one of the PCs 21 to the image processing apparatus 10 and the image processing apparatus 10 is instructed to perform, for example, an image formation operation (or a print operation) from a remote location. Alternatively, there is a case in which a user stands in front of one of the image processing apparatuses 10 and instructs the image processing apparatus 10 to perform processing such as copy processing, image reading processing (or scan processing), or fax sending and receiving processing by performing various types of operations.



FIG. 2 illustrates the image processing apparatus 10 according to the present exemplary embodiment.

The image processing apparatus 10 has a housing 10A provided with doors that may be opened and closed at positions at which the doors are needed. For example, a front door 10B is illustrated in FIG. 2; however, doors may also be provided at right and left sides of the housing 10A. The front door 10B is opened in the case where an operator reaches inside the image processing apparatus 10 and does some work, for example, when a paper jam occurs, consumables are replaced, a periodic check is performed, or the like. The front door 10B is normally closed during operation.

The image processing apparatus 10 includes an image forming unit 240 that forms an image on a piece of recording paper, an image reading unit 238 that reads a document image, and a facsimile communication control circuit 236. The image processing apparatus 10 includes a main controller 200. The main controller 200 temporarily stores image data of a document image read by the image reading unit 238 or transmits the read image data to the image forming unit 240 or to the facsimile communication control circuit 236 by controlling the image forming unit 240, the image reading unit 238, and the facsimile communication control circuit 236.

The main controller 200 is connected to the network-communication network 20 such as the Internet. The facsimile communication control circuit 236 is connected to a telephone network 22. The main controller 200 is connected to a host computer via, for example, the network-communication network 20 and receives image data. The main controller 200 sends and receives a fax via the facsimile communication control circuit 236 through the telephone network 22.

The image reading unit 238 includes a document plate, a scanning drive system, and a photoelectric conversion element. A document is positioned on the document plate. The scanning drive system scans an image formed on the document that is positioned on the document plate and irradiates the image with light. The photoelectric conversion element, such as a charge-coupled device (CCD), receives reflected or transmitted light, which is obtained by scanning the image with the scanning drive system, and converts the reflected or transmitted light into an electric signal.

The image forming unit 240 includes a photoconductor drum. Around the photoconductor drum, a charging device, a scanning exposure section, an image development section, a transfer section, and a cleaning section are provided. The charging device uniformly charges the photoconductor drum. The scanning exposure section scans the photoconductor drum by using a light beam in accordance with image data. The image development section develops an electrostatic latent image that has been formed by scanning the photoconductor drum with the scanning exposure section in such a manner that the photoconductor drum is exposed to the light beam. The transfer section transfers an image that has been developed on the photoconductor drum, onto a piece of recording paper. The cleaning section cleans the surface of the photoconductor drum after transfer is performed by the transfer section. Furthermore, a fixing section that fixes the image which has been transferred onto the piece of recording paper is provided along a path along which the piece of recording paper is transported.

The image processing apparatus 10 has an input power line 244, and a plug 245 is attached to an end of the input power line 244. The plug 245 is inserted into an outlet 243 provided on a wall surface W and wired into a commercial power source 242, so that the image processing apparatus 10 receives power from the commercial power source 242.

FIG. 3 is a schematic diagram of a hardware configuration of a control system of the image processing apparatus 10.

The main controller 200 is connected to the network-communication network 20. The facsimile communication control circuit 236, the image reading unit 238, the image forming unit 240, and a UI touch panel 216 are connected to the main controller 200 via buses 33A to 33D, respectively, such as data buses and control buses. In other words, the main controller 200 controls the individual processing units of the image processing apparatus 10. Note that a backlight unit 216BL (see FIG. 4) for UI touch panels may be attached to the UI touch panel 216.

Furthermore, the image processing apparatus 10 includes a power-source device 202, and the power-source device 202 is connected to the main controller 200 via a harness 33E. The power-source device 202 receives power from the commercial power source 242. The power-source device 202 is provided with power supply lines 35A to 35D, which are independent of one another. Power is supplied to the facsimile communication control circuit 236, the image reading unit 238, the image forming unit 240, and the UI touch panel 216 through the power supply lines 35A to 35D, respectively. Accordingly, the main controller 200 may control power supply so as to selectively supply power to the individual processing units (devices) (while the image processing apparatus 10 is in a power-supply mode) or so as to selectively stop supplying power to the individual processing units (devices) (while the image processing apparatus 10 is in a sleep mode). As a result, what is called partial power saving control may be realized.

Moreover, plural sensors (a first sensor 28, a second sensor 29, and a third sensor 30) are connected to the main controller 200 and monitor whether there is a person in the surrounding area of the image processing apparatus 10. The first sensor 28, the second sensor 29, and the third sensor 30 will be described below.

FIG. 4 is a schematic diagram of a configuration that mainly shows the processing units (which may be referred to as "loads", "devices", "modules", or the like), the main controller 200, and power lines of the power-source device 202. The processing units may be operated by receiving power and are controlled by the main controller 200. Power is supplied to the individual devices through the power lines. In the present exemplary embodiment, power may be selectively supplied to the individual processing units on a processing-unit-by-processing-unit basis in the image processing apparatus 10 (partial power saving).

Note that partial power saving performed on a processing-unit-by-processing-unit basis is an example. The processing units may be divided into groups, and power saving may be controlled on a group-by-group basis. Alternatively, the processing units may be grouped together, and power saving may be controlled.

Moreover, partial power saving is also performed for the main controller 200. In the case where power saving is being performed for all the processing units, a monitoring controller 24, which will be described below (see FIG. 4), receives the bare minimum amount of power and no power is supplied to the other devices controlled by the main controller 200. (This state may also be referred to as a "power saving mode" or the "sleep mode".)

As illustrated in FIG. 4, the main controller 200 includes a central processing unit (CPU) 204, a random-access memory (RAM) 206, a read-only memory (ROM) 208, an input/output (I/O) unit 210, and a bus 212 that includes data busses, control busses, and the like. The CPU 204, the RAM 206, the ROM 208, the I/O unit 210, and the main controller 200 are con-

nected to one another via the bus **212**. The UI touch panel **216** (including the backlight unit **216BL**) is connected via a UI control circuit **214** to the I/O unit **210**. In addition, a hard disk drive (HDD) **218** is connected to the I/O unit **210**. The CPU **204** operates in accordance with programs stored on the ROM **208**, the HDD **218**, or the like, and consequently, the functions of the main controller **200** are realized. Note that the programs may be installed from a recording medium (such as a compact disc (CD), a digital versatile disc (DVD), a Blu-ray Disc (BD), a Universal Serial Bus (USB) memory, or a Secure Digital (SD) memory) on which the programs are stored. The CPU **204** may operate in accordance with the installed programs, and consequently, an image processing function may be realized.

A timer circuit **220**, a communication line interface (I/F) **222**, the facsimile communication control circuit (modem) **236**, the image reading unit **238**, and the image forming unit **240** are also connected to the I/O unit **210**.

Note that the timer circuit **220** measures elapsed time, which is used to cause the facsimile communication control circuit **236**, the image reading unit **238**, and the image forming unit **240** to be in a power saving state (a power-supply shutoff state). (Hereinafter, the timer circuit **220** may also be referred to as a "system timer".)

Power is supplied from the power-source device **202** to the main controller **200** and the individual devices (the facsimile communication control circuit **236**, the image reading unit **238**, and the image forming unit **240**) (see dotted lines in FIG. 4). Note that, in FIG. 4, each power line is represented by a single line (dotted line); however, in the case where the polarity and the like are controlled by the main controller **200**, in reality, the power line often physically contains two or three lines.

As illustrated in FIG. 4, the input power line **244**, which is routed from the commercial power source **242**, is connected to a main switch **246**. When the main switch **246** is turned on, power may be supplied to a first power-source unit **248** and a second power-source unit **250**.

The first power-source unit **248** includes a control-power generating section **248A**. The control-power generating section **248A** is connected to a power-supply control circuit **252** of the main controller **200**. The power-supply control circuit **252** receives power for the main controller **200** and is connected to the I/O unit **210**. The power-supply control circuit **252** performs, in accordance with a control program for the main controller **200**, switching control for supplying or shutting off power through the power supply lines at least to the individual devices (the facsimile communication control circuit **236**, the image reading unit **238**, and the image forming unit **240**).

In contrast, a power line **254** connected to the second power-source unit **250** is provided with a first sub-power-source switch **256** (hereinafter may also be referred to as a "SW-1"). The SW-1 is controlled to be On/Off by the power-supply control circuit **252**. That is, when the SW-1 is Off, the second power-source unit **250** does not work. (The individual units downstream of the "SW-1" are in the state of zero power consumption).

The second power-source unit **250** includes a 24-V power supply section **250H** (LVPS2) and a 5-V power supply section **250L** (LVPS1). The 24-V power supply section **250H** (LVPS2) is a power source that is mainly used, for example, for motors.

The 24-V power supply section **250H** (LVPS2) of the second power-source unit **250** is connected to a power supply unit **258** for the image reading unit **238**, a power supply unit **260** for the image forming unit **240**, a power supply unit **264**

for the facsimile communication control circuit **236**, and a power supply unit **266** for the UI touch panel **216**. The 5-V power supply section **250L** (LVPS1) of the second power-source unit **250** is connected to the power supply unit **260** for the image forming unit **240**, the power supply unit **264** for the facsimile communication control circuit **236**, and the power supply unit **266** for the UI touch panel **216**.

The power supply unit **258** for the image reading unit **238** uses the 24-V power supply section **250H** (LVPS2) as an input source, and is connected to the image reading unit **238** via a second sub-power-source switch **268** (hereinafter may be referred to as a "SW-2").

The power supply unit **260** for the image forming unit **240** uses the 24-V power supply section **250H** (LVPS2) and the 5-V power supply section **250L** (LVPS1) as input sources, and is connected to the image forming unit **240** via a third sub-power-source switch **270** (hereinafter may be referred to as a "SW-3").

The power supply unit **264** for the facsimile communication control circuit **236** uses the 24-V power supply section **250H** (LVPS2) and the 5-V power supply section **250L** (LVPS1) as input sources, and is connected to the facsimile communication control circuit **236** via a fourth sub-power-source switch **274** (hereinafter may be referred to as a "SW-4").

The power supply unit **266** for the UI touch panel **216** uses the 5-V power supply section **250L** (LVPS1) and the 24-V power supply section **250H** (LVPS2) as input sources, and is connected to the UI touch panel **216** (including the backlight unit **216BL**) via a fifth sub-power-source switch **276** (hereinafter may be referred to as a "SW-5"). Note that power may be supplied for fundamental functions of the UI touch panel **216** (the fundamental functions excluding the functions regarding the backlight unit **216BL**) from the monitoring controller **24**.

As in the case of the first sub-power-source switch **256**, each of the second sub-power-source switch **268**, the third sub-power-source switch **270**, the fourth sub-power-source switch **274**, and the fifth sub-power-source switch **276** is controlled to be On/Off in accordance with a power-supply selection signal supplied from the power-supply control circuit **252** of the main controller **200**. Although not illustrated, switches and wiring lines that are used to supply power from the 24-V power supply section **250H** and the 5-V power supply section **250L** form two channels. Furthermore, each of the second sub-power-source switch **268**, the third sub-power-source switch **270**, the fourth sub-power-source switch **274**, and the fifth sub-power-source switch **276** may be arranged in a corresponding one of the individual devices to which power is to be supplied, instead of being arranged in the power-source device **202**. Power supplied from the commercial power source **242** (for example, 100 V) is directly supplied from the downstream side of the first sub-power-source switch **256** ("SW-1") to the fixing section, which is not illustrated in FIG. 4 and corresponds to a "Fuser" illustrated in FIG. 3, of the image forming unit **240**. The fixing section is electrically connected only when the image forming unit **240** needs the fixing section.

In the above-described configuration, power supplied from the power sources is selectively supplied to the individual devices (the facsimile communication control circuit **236**, the image reading unit **238**, and the image forming unit **240**) for realizing a specified function. Since power is not supplied to devices that are not necessary for the specified function, power consumption may be minimized.

Here, in some cases, the main controller **200** in the present exemplary embodiment may partially stop the functions

thereof (partial power saving) in order to realize minimum power consumption. In some cases, power supply is shut off to the greater part of the main controller **200** in addition to processing units. Such cases are collectively referred to as the “sleep mode” (the power saving mode).

The image processing apparatus **10** may enter the sleep mode, for example, by activating the system timer at a point in time when image processing finishes. In other words, power supply is stopped after a predetermined time has elapsed since activation of the system timer. Note that, when a certain operation is performed (for example, a hard key is operated) before the predetermined time elapses, as a matter of course, measurement of the predetermined time with the system timer for entering the sleep mode is stopped, and the system timer is activated at a point in time when the next image processing finishes.

In contrast, the monitoring controller **24** (see FIG. 4) is an element that constantly receives power even when the image processing apparatus **10** is in the sleep mode. The monitoring controller **24** is connected to the I/O unit **210**. The monitoring controller **24** may include, for example, an integrated circuit (IC) chip, which is referred to as an “application-specific integrated circuit (ASIC)”, in which an operation program is stored, and which includes a CPU, a RAM, a ROM, and so forth by which the operation program is performed.

When monitoring is being performed while the image processing apparatus **10** is in the sleep mode, for example, a print request may be received via a communication-line detector or a facsimile (FAX) reception request may be received via a FAX line detector. In such a case, the monitoring controller **24** causes power to be supplied to the devices for which power saving is being performed, by controlling the first sub-power-source switch **256**, the second sub-power-source switch **268**, the third sub-power-source switch **270**, the fourth sub-power-source switch **274**, and the fifth sub-power-source switch **276** via the power-supply control circuit **252**.

A power-saving control button **26** is connected to the I/O unit **210** of the main controller **200**. Power saving mode may be cancelled if a user operates the power-saving control button **26** while power saving is being performed. Note that the power-saving control button **26** may also have a function of forcibly shutting off power supply to processing units and causing the processing units to be in the power-saving state when the power-saving control button **26** is operated while power is being supplied to the processing units.

Here, it is desirable that the bare minimum amount of power for operation be supplied to the power-saving control button **26** and individual detectors in addition to the monitoring controller **24** while power saving is being performed, in order to perform monitoring while the image processing apparatus **10** is in the sleep mode. In other words, even when the image processing apparatus **10** is in the sleep mode, which is a non-power-supply state, the power-saving control button **26** and the individual detectors in addition to the monitoring controller **24** may receive power whose amount is equal to or lower than a predetermined value (for example, 0.5 W or lower) and that is necessary to perform determination control as to whether power is to be supplied or not. In this case, the power supply source is not limited to the commercial power source **242**, and may be a storage battery, a solar battery, a rechargeable battery that is recharged when power is supplied from the commercial power source **242**, or the like. The commercial power consumption (or power expenses) while the image processing apparatus **10** is in the sleep mode may be zero by using no commercial power source **242**.

Note that, in a specific time period while the image processing apparatus **10** is in the sleep mode, the bare minimum

amount of power for operation may be mainly supplied to an input system such as the UI touch panel **216** and an IC card reader **217**. In this case, it is desirable that the backlight unit **216BL** be turned off or the illumination thereof be reduced to be lower than in a normal mode.

In a case where a user who stands in front of the image processing apparatus **10** operates the power-saving control button **26** during the sleep mode and power supply is restarted, there may be a case where a certain period of time is required for start-up of the image processing apparatus **10**.

Thus, the first sensor **28** is connected to the monitoring controller **24** in the present exemplary embodiment. Furthermore, power supply is started early upon detection performed by the first sensor **28** before a user operates (or, for example, presses) the power-saving control button **26**, and consequently, the user may use the image processing apparatus **10** earlier than the case where power supply is started upon operation of the power-saving control button **26** performed by the user.

In the present exemplary embodiment, a person presence sensor may be used as the first sensor **28** because the first sensor **28** senses movement of moving objects including a user. Hereinafter, the first sensor **28** is referred to as a “person presence sensor **28**”.

The term person presence sensor **28** contains the words “person presence”. This is an appropriate name for use in the present exemplary embodiment, and it is desirable that the person presence sensor **28** be capable of sensing (or detecting) at least persons. In other words, the person presence sensor **28** may sense moving objects other than a person. Thus, in the following, there may be a case where what the person presence sensor **28** detects is referred to as a person; however, animals, robots, and the like that execute a requested order instead of a person will be future detection targets. Note that, in contrast, if there are sensors that are capable of detecting and identifying a person, such a special sensor may be used as the person presence sensor **28**. In the following, a moving object, a person, a user, and the like are considered to be the same in terms of a detection target, which is to be detected by the person presence sensor **28**, and are considered to be different from one another as necessary.

According to the specifications of the person presence sensor **28** according to the present exemplary embodiment, the first sensor **28** detects movement of a moving object in the surrounding area of the image processing apparatus **10**. In this case, a representative example of the person presence sensor **28** is an infrared radiation sensor (a pyroelectric type sensor) using a pyroelectric effect of a pyroelectric element. In the present exemplary embodiment, a pyroelectric type sensor is used as the person presence sensor **28**.

The greatest feature of a sensor using a pyroelectric effect of a pyroelectric element, the sensor being used as the person presence sensor **28**, is that power consumption is lower and a detection area is broader than, for example, those of a reflex sensor provided with a projection section and a reception section. Since the person presence sensor **28** detects movement of a moving object, the person presence sensor **28** does not detect presence of a person when the person stays still even though the person is in the detection area. For example, there is a case where a high-level signal is output when a person is moving. When the person stays still in the detection area, the high-level signal becomes a low-level signal.

Note that “still” in the present exemplary embodiment includes not only a notion of absolute standstill as in still images taken by still cameras or the like but also a case where, for example, a person stops in front of the image processing apparatus **10** so as to perform operation. Thus, “still” in the

present exemplary embodiment also includes a case where a person moves slightly (for example, due to breathing) within a predetermined range and a case where a person moves arms, legs, the neck, or the like within a predetermined range.

Note that, when a person performs stretching exercise or the like in front of the image processing apparatus 10 while the person is waiting for, for example, the completion of image forming processing, image reading processing, or the like, the person presence sensor 28 may detect the presence of the person.

Thus, the sensitivity of the person presence sensor 28 does not have to be adjusted by defining what is considered to be “still”, and may be adjusted relatively roughly and in a standard manner so as to depend on the sensitivity characteristics of the person presence sensor 28. That is, when the person presence sensor 28 outputs one of binary signals (for example, a high-level signal), this means that a person is present in the detection area and the person is moving. When the other one of the binary signals (for example, a low-level signal) is output, this means “still”.

In the present exemplary embodiment, when the person presence sensor 28 detects the moving object, power supply to the second sensor 29 is started. The second sensor 29 is connected to the monitoring controller 24. The second sensor 29 is in the power-supply shutoff state while the image processing apparatus 10 is in the sleep mode; however, power is supplied thereto when the person presence sensor 28 detects a moving object.

In the present exemplary embodiment, a sensor with a camera function for detecting movement information on a moving object (a user) (including distance information regarding how far or near the moving object is and movement direction information) is used as the second sensor 29. Hereinafter, the second sensor 29 is referred to as an “access camera 29”.

The access camera 29 captures images with which at least the transition of the position of the moving object may be recognized. Note that, when the position of a moving object is detected, if the moving object emits a signal, a radar unit may be used as the access camera 29; however, description will be made on the assumption that the moving object in the present exemplary embodiment emits no signal.

In the present exemplary embodiment, when it is determined, by using the access camera 29, that the moving object is approaching the image processing apparatus 10, especially the UI touch panel 216, for example, shifting from the sleep mode to a specific mode (in which power is supplied to the main controller 200, the UI touch panel 216, and the third sensor 30) is triggered. Note that the backlight unit 216BL, which is turned off when the user is approaching, may be turned on when the user is facing the UI touch panel 216.

Moreover, “confirmation” that a user is approaching the UI touch panel 216 is performed also when it is “predicted” that the user is approaching the UI touch panel 216. Thus, such a “confirmation” is made also in the case where the user makes a U-turn and does not face the UI touch panel 216 in the end.

In the present exemplary embodiment, in the case where the access camera 29 detects that the moving object is approaching and it is predicted that the moving object will soon face the UI touch panel 216 through the access function of the access camera 29, power supply to the third sensor 30 is started. The third sensor 30 is connected to the I/O unit 210 of the main controller 200.

In the present exemplary embodiment, a sensor with a camera function that is used to detect identity recognition

information for a user is used as the third sensor 30. Hereinafter, the third sensor 30 is referred to as a “recognition camera 30”.

The recognition camera 30 detects identity recognition information on a user. For example, the access camera 29 captures an image of a characteristic part of the user such as the face or the like. The main controller 200 performs verification and analysis in accordance with the information of the characteristics of the image of a face or the like captured by the recognition camera 30, by using an image database regarding the characteristics of faces that have been stored in advance on the ROM 208 or the HDD 218. As a result, for example, identity authentication is performed for the user or a personalized screen for the user is automatically displayed on an operation panel by linking information of the characteristics of the user to the personalized screen. Thus, authentication operation and operation for searching information on the user are made simpler, and the user is free from complicated operation through buttons. Therefore, pleasant and less operation procedures may be realized.

That is, a moving object that is approaching the image processing apparatus 10 is detected through the function of the access camera 29, and the identity of the moving object is authenticated through the function of the recognition camera 30 in the present exemplary embodiment. However, a moving object that is approaching the image processing apparatus 10 may be detected and the identity of the moving object may be authenticated through the function of the access camera 29, and a UI screen appropriate for the authenticated moving object may be selected or the like and pleasant and less operation procedures may be realized through the function of the recognition camera 30.

The identity recognition information is used to determine whether the user has the right to access the image processing apparatus 10, to determine which types of device or the like are to be used, and to control the operation of the image processing apparatus 10.

For example, the identification information on the user, which is the identity recognition information, is registered in advance together with a corresponding job type from the PC 21 on the desk of the user. After an image of a face or the like of the user is captured, the corresponding job type may be specified by executing authentication processing in accordance with information of the image of a face and by verifying the identification information obtained from the information of the image of the face against the identification information that has been registered together with the corresponding job type.

Note that what is captured by the recognition camera 30 is not limited to the image of a face of a user 60. An image of bar codes or Quick Response (QR) Code (registered trademark) of an item (an ID card or documents) that the user 60 has or carries may be captured and used to perform verification.

As illustrated in FIG. 2, the person presence sensor 28 and the access camera 29 are provided on a pillar unit 50 on the housing 10A of the image processing apparatus 10. The pillar unit 50 has a vertically elongated rectangular shape. Moreover, the recognition camera 30 is provided near the UI touch panel 216.

The pillar unit 50 is provided so as to connect an upper housing that mainly covers the image reading unit 238 and a lower housing that covers mainly the image forming unit 240. The pillar unit 50 has a column shape. In the pillar unit 50, a recording paper transport system and the like, not illustrated, are installed. FIG. 5 is an enlarged view of the pillar unit 50.

As illustrated in FIG. 5, the pillar unit 50 has a cover member 52 on the front surface thereof. The cover member 52

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covers the pillar unit **50** as an aesthetic element and has a vertically elongated rectangular shape.

As illustrated in FIG. 5, the top end portion of the cover member **52** has a slit opening **55**, which is vertically long. The access camera **29** is provided at the back side of the slit opening **55**. Although not illustrated, a concealing member whose transmittance is relatively low (whose transmittance is 50% or lower) is placed in the slit opening **55**. This concealing member conceals the access camera **29**, and consequently, it is harder to see the access camera **29** from the outside. This concealing member is provided as an aesthetic element, and the detection function of the access camera **29** is basically maintained.

There is a space between the bottom surface of the cover member **52** and the top surface of the lower housing. The bottom end portion of the cover member **52** is chamfered and has what is called a chamfered shape, which is a chamfered surface **52A**. A through hole **57** is provided on the chamfered surface **52A**.

The person presence sensor **28** is provided on the side behind the through hole **57** (at the back side of the cover member **52**). Thus, the through hole **57** functions as a monitor window through which the person presence sensor **28** detects a moving object.

As illustrated in FIG. 6, a recognition camera unit **40** is provided at a position next to and to the left of the UI touch panel **216** in the image processing apparatus **10**.

In the recognition camera unit **40**, a lens of the recognition camera **30** is exposed at the surface of a base unit **42**. The lens is provided at a position from which an image is optically formed on an image pickup device (not illustrated) provided under the base unit **42**.

An adjustment unit **44** is provided under (the lens of) the recognition camera **30** in the base unit **42**. The adjustment unit **44** has, for example, the shape of a directional pad. The optical axis of the lens of the recognition camera **30** may be mechanically adjusted vertically and horizontally by performing a vertical or horizontal operation using the adjustment unit **44**. Note that the adjustment unit **44** is not always necessary and the image pickup area of the lens may be fixed.

As illustrated in FIG. 7, the optical axis of the recognition camera **30** is adjusted by using the adjustment unit **44** or is adjusted to be at a fixed standard position before shipment of the recognition camera **30** in such a manner that an image of a face of a user who will soon face or is facing the UI touch panel **216** of the image processing apparatus **10** may be captured.

Moreover, an image capturing timing of the recognition camera **30** is controlled so as to cooperate with the person presence sensor **28** and the access camera **29**. That is, power supply to the recognition camera **30** is shut off at least while the image processing apparatus **10** is in the sleep mode. Here, in the case where a moving object is detected by the person presence sensor **28** and it is predicted by using the access camera **29** that the user **60** will soon face the UI touch panel **216** while the image processing apparatus **10** is in the sleep mode, power is supplied to the recognition camera **30** and capturing of specific images is started.

By analyzing a specific image captured by the recognition camera **30**, it is determined whether the user **60** will soon face the UI touch panel **216**. The specific image is analyzed to perform face recognition for the user **60**. The main controller **200** performs identity recognition for the user **60** who will soon face the UI touch panel **216** by using the recognition camera **30**. In the case where the user **60** is identified, control of power supply to the individual devices of the image processing apparatus **10** is executed.

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In contrast, for example, in the case where it is not confirmed that the user **60** will soon face the UI touch panel **216**, power supply to the recognition camera **30** may be shut off in accordance with a time period during which it is not confirmed that the user **60** will soon face the UI touch panel **216**.

The access camera **29** and the recognition camera **30** detect, in the surrounding area of the image processing apparatus **10**, presence of a moving object, the shape (outline) of the moving object, information on movement of the moving object in time series, and the like. For example, an image sensor (a charge-coupled device (CCD) image sensor or a complementary metal-oxide-semiconductor (CMOS) image sensor) may be used as the access camera **29** and the recognition camera **30**.

Image sensors are general sensors used to capture moving images, and thus detailed description thereof will be omitted here. Briefly, an image sensor has a structure as described below.

An image sensor is made mainly from a semiconductor device using a silicon monocrystal. The number of free electrons (or signal charges) that are generated due to the photoelectric effect is measured and the amount of light that has hit the image sensor is recognized. As a system that holds the generated signal charges, a photodiode is mainly used.

When a color image sensor is used, differences in brightness may be obtained from the amount of the signal charges from the photodiode but differences between colors are not obtained from the amount of the signal charges from the photodiode. Thus, pixels are equipped with color filters, and the color filter of each pixel passes light having a specific color corresponding to the color filter.

For example, color filters are arranged in a Bayer pattern for pixels in an image sensor for digital cameras. The three primary colors are red, green, and blue. Red, green, and blue filters are used as the color filters. The number of green filters used is twice the number of the red or blue filters. This is because the human eye is more sensitive to green light than to light of the other colors. (We perceive green light to be brightest even when red, blue, and green light have the same energy.) This makes the resolution of the captured image higher.

In contrast, image sensors (a CCD camera or the like) used as the access camera **29** and the recognition camera **30** in the present exemplary embodiment do not have to be adjusted in accordance with the sensitivity of the human eye. In other words, in the case where an image sensor is used as the access camera **29**, the arrangement of color filters is determined in accordance with what is analyzed on the basis of an output signal supplied from the access camera **29** and the image sensor is adjusted in accordance with the specifications of the access camera **29**. The same applies to the case where an image sensor is used as the recognition camera **30**.

As the specifications of the access camera **29**, it is desirable that the resolution of the access camera **29** be at a level at which the course of a moving object that is approaching the image processing apparatus **10** is understandable and the field of view (the image capturing area) of the access camera **29** needs to be broader (or especially has a wider angle) than that of the person presence sensor **28**.

For example, the person presence sensor **28** has a detection area **F** that is fixed at an angle inclined downward (in the direction toward the floor surface on which the image processing apparatus **10** is installed) and has an angle of view set to about 100° to 120°. The reason that the detection area **F** is fixed at an angle inclined downward (in a downward direction) is to limit the detection distance and to avoid unnecessary start-up (power supply) while the image processing

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apparatus 10 is in the sleep mode. The reason that the angle of view is set to about 100° to 120° is to avoid detection of a moving object that passes in the surrounding area of the image processing apparatus 10.

In contrast, by limiting the detection area F, there is a case in which the positions of all the users who operate the image processing apparatus 10 near the image processing apparatus 10 are not detected, after power is supplied. For example, a user who operates at a finisher portion positioned at an end of the image processing apparatus 10 in the lateral direction is outside the detection area F of the person presence sensor 28, and the image processing apparatus 10 may enter the sleep mode while the user is operating the image processing apparatus 10. Thus, a dead-angle area of the person presence sensor 28 is compensated by utilizing the access camera 29.

As the specifications of the recognition camera 30, for example, face recognition may be performed for a user who will soon face the image processing apparatus 10, instead of performing IC card authentication, which is an identity recognition function. In the case where the image of a face captured by the recognition camera 30 is recognized through verification performed by using a face image database, power is supplied to necessary devices, which may be all the devices. The face recognition is performed using a filter structure (a filter structure with which mainly the outline of the face, the eyes, the nose, the mouth, and the like are clearly detected).

In the present exemplary embodiment, information output from the recognition camera 30 is analyzed mainly for face identification; however, a filter structure that makes it possible to detect an ID card that has been recently steadily carried by a user (for example, an ID card worn around the neck of a user, an ID card clipped to a user's breast pocket, or the like) or a filter structure that makes reading of bar codes on an ID card easier may be used.

In addition, as another example, in the case where devices that are needed to start up are determined in accordance with the type of document that a user approaching the image processing apparatus 10 has, a filter structure that makes determination of the type of document easier may be used. For example, in the case where the format of a fax cover sheet is recognized, the following may be performed: devices that are necessary for fax transmission start up, the display content on the UI touch panel 216 is determined by identifying whether the document is black and white or color, and the like.

FIGS. 7 to 10 illustrate an example of comparison between the detection area F of the person presence sensor 28, a detection area R of the access camera 29, and a detection area La of the recognition camera 30.

The detection area F in FIG. 8 is the detection area for the person presence sensor 28. As described above, the detection area F of the person presence sensor 28 has a wide angle of about 100° to 120° and faces toward the floor surface on which the image processing apparatus 10 is installed.

In contrast, an area defined by a dotted line in FIG. 8 is the detection area R of the access camera 29. It is clear that the detection area R of the access camera 29 covers an area that the detection area F of the person presence sensor 28 does not cover.

The area represented by arrows La drawn with a dotted line, the center line of the area being the optical axis L, in FIG. 7 is the detection area La (an image capturing area) of the recognition camera 30. The recognition camera 30 captures an image of a face of the user 60 in the case where the user 60 will soon face or is facing the UI touch panel 216.

In the following, the operation according to the present exemplary embodiment will be described.

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The operation state of the image processing apparatus 10 shifts to the sleep mode when no processing is being performed. In the present exemplary embodiment, power is supplied only to the monitoring controller 24.

Here, when start-up is triggered (when it is predicted that a user is approaching the image processing apparatus 10 by using the access camera 29, when an operation for canceling the power saving mode is performed, or when an input operation (for example, a key input operation) is performed on the UI touch panel 216 or the like), the main controller 200, the UI touch panel 216, and the recognition camera 30 start up. For example, in the case where a user who has been authenticated through face recognition and may access the image processing apparatus 10 inputs a job (by using keys) from the UI touch panel 216 or the like, the image processing apparatus 10 enters a warm-up mode in accordance with the type of job.

When a warm-up operation ends in the warm-up mode, the image processing apparatus 10 enters a standby mode or a running mode.

In the standby mode, the image processing apparatus 10 is literally in a mode in which the image processing apparatus 10 is ready for operation. The image processing apparatus 10 is in a state in which the image processing apparatus 10 may perform operation for image processing at any time.

Thus, a job execution operation is commanded through a key input operation, the operation state of the image processing apparatus 10 shifts to the running mode and image processing according to the commanded job is executed.

When the image processing ends (or when all sequential jobs end in the case where sequential and plural jobs are waiting in a queue), this triggers standby and the operation state of the image processing apparatus 10 shifts to the standby mode.

When a job is commanded to be executed while the image processing apparatus 10 is in the standby mode, the operation state of the image processing apparatus 10 shifts to the running mode again. In contrast, for example, in the case where it is detected that the user is away from the image processing apparatus 10 (or it is predicted that the user will soon be away from the image processing apparatus 10) by using the access camera 29 or in the case where a predetermined time has elapsed, the operation state of the image processing apparatus 10 shifts to the sleep mode.

In the present exemplary embodiment, control of power supply is executed in such a manner that the person presence sensor 28, the access camera 29, and the recognition camera 30 cooperate with each other. More specifically, power is constantly supplied to the person presence sensor 28; however, control is performed in accordance with detection information supplied from the person presence sensor 28 in such a manner that power is sequentially supplied to the access camera 29 and to the recognition camera 30. This further contributes to energy saving in addition to control of power supply to devices.

In the following, a power-supply control routine, in which the person presence sensor 28, the access camera 29, and the recognition camera 30 cooperate with each other, will be described in accordance with a flowchart illustrated in FIG. 11.

The processing procedures illustrated in FIG. 11 are executed when the image processing apparatus 10 enters the sleep mode. While the image processing apparatus 10 is in the sleep mode, no power is supplied to the greater part of the main controller 200, the UI touch panel 216, various devices, the access camera 29, and the recognition camera 30. (That is, the greater part of the main controller 200, the UI touch panel

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216, the various devices, and the access camera 29 are in the power-supply shutoff state.) In contrast, power is supplied to the monitoring controller 24 and the person presence sensor 28 in the main controller 200. (That is, the monitoring controller 24 and the person presence sensor 28 are in the power supply state.) The power is about, for example, 0.5 W. (The power here corresponds to "LEVEL 1" in FIG. 11).

In step S100, it is determined whether the person presence sensor 28 detects a moving object. If YES in step S100, the procedure proceeds to step S102. In step S102, the access camera 29 is started up. After the access camera 29 is started up, the power becomes larger than LEVEL 1. (The power in step S102 corresponds to "LEVEL 2" in FIG. 11.)

In step S104, the direction in which the moving object is moving is determined in accordance with images captured by the access camera 29. As the direction in which the moving object is moving, the direction in which the moving object is expected to move is determined by recognizing at least the form of a person and by detecting the orientation of the person and the orientation of the face of the person. (This determination is performed by image analysis.)

In step S106, it is determined whether it is predicted that the moving object (the user 60) is approaching the image processing apparatus 10 by the image analysis based on the images captured by the access camera 29. The reason that the determination in step S106 is made on the basis of "prediction" is that the determination is made assuming that the user 60 will soon move straight in the direction determined in step S104. For example, the moving object may change its course with respect to the direction determined in step S104 (that is, the moving object may turn right/left, make a U-turn, or the like). This is why the determination in step S106 is made on the basis of "prediction".

If NO in step S106, that is, when it is predicted that the moving object is not moving toward the image processing apparatus 10, the procedure proceeds to step S108. In step S108, power supply to the access camera 29 is shut off, and the procedure returns to step S100. In this case, the power shifts from LEVEL 2 to LEVEL 1.

In step S106, NO is obtained when the moving object detected by the person presence sensor 28 is, for example, a moving object that simply passes by the image processing apparatus 10. In the case where such a moving object is already away from the image processing apparatus 10, step S100 is repeatedly performed. In contrast, in the case the moving object stays but stops moving in the detection area of the person presence sensor 28 (the detection area F illustrated in FIG. 7), the access camera 29 is started up again.

Note that a delay time may be set before power supply to the access camera 29 is shut off in step S108, and image analysis of the moving object in the direction of movement may be continued during the delay time after the procedure returns to step S100. This makes it possible to compensate the dead-angle area of the person presence sensor 28.

If YES in step S106, that is, when it is predicted that the moving object is moving toward the image processing apparatus 10 (or it is predicted that the moving object is approaching the image processing apparatus 10), the procedure proceeds to step S110. In step S110, power is supplied to the main controller 200, the UI touch panel 216, and the recognition camera 30. As a result, the power becomes larger than LEVEL 2. (The power in step S110 corresponds to "LEVEL 3" in FIG. 11.)

In step S112, capturing of images is started by using the recognition camera 30. Then, the procedure proceeds to step S114. In step S114, it is determined whether the moving object (the user 60) is still approaching the image processing

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apparatus 10. This is because the moving object is once moving toward the image processing apparatus 10 but later may change its course. If NO in step S114, the procedure proceeds to step S116. In step S116, power supply to the UI touch panel 216 and the recognition camera 30 is shut off. Then, the procedure returns to step S104. In this case, the power shifts from LEVEL 3 to LEVEL 2.

If YES in step S114, the procedure proceeds to step S118. In step S118, it is determined whether the user 60 will soon face the UI touch panel 216 or not. That is, it may be determined whether or not the user 60 will soon face the UI touch panel 216, by analyzing of an image (especially, an image of a face) of the user 60 captured by the recognition camera 30.

If NO in step S118, that is, when it is determined that capturing of an image (or an image of a face) of the user 60 is unsuccessful, the procedure proceeds to step S120. In step S120, it is determined whether a predetermined time has elapsed or not. If NO in step S120, the procedure returns to step S114. Then, the above-described processing procedures (steps S114, S118, and S120) are repeated.

If YES in step S120, it is understood that the predetermined time has elapsed in a state in which the user 60 is approaching the image processing apparatus 10 but does not face the UI touch panel 216. Then, the procedure proceeds to step S116. In step S116, power supply to the UI touch panel 216 and the recognition camera 30 is shut off. Then, the procedure returns to step S104. In this case, the power shifts from LEVEL 3 to LEVEL 2.

Here, YES is obtained in step S120, for example, in a state in which the user 60 is waiting for a printout that has been commanded from the PC 21 or the like on the desk of the user 60 at a position that is shifted from the front side of the image processing apparatus 10 (that is, at a position near the paper outlet tray), in a state in which the user 60 is working near the image processing apparatus 10 in order to replace consumables such as toner or recording paper, or the like.

On the other hand, if YES in step S118, that is, when it is determined that capturing of, for example, an image of a face of the user 60 is successful and the user 60 will soon face the UI touch panel 216, the procedure proceeds to step S122. In step S122, identity recognition processing (or authentication processing) is executed. In the identity recognition processing, the captured image of a face is analyzed and compared with data stored in the face image database stored on the ROM 208 or the HDD 218 in the main controller 200, and it is determined whether or not the user 60 is a user with the right to use the image processing apparatus 10.

Note that information used for the authentication processing is not limited to images of faces. Identification information of the bar code, the QR Code (registered trademark), or the like of an ID card or a document carried by the user 60 may be read and authentication processing may be performed.

In step S124, the operation of the image processing apparatus 10 is controlled in a management manner determined in accordance with the result of the identity recognition. That is, when the user 60 is an authenticated user, power is supplied to the devices including, as the main part, the image reading unit 238 and the image forming unit 240. When the user 60 is not an authenticated user, a reason or the like why the user 60 has not been authenticated is displayed on the UI touch panel 216. When power is supplied to the devices as described above, the power becomes larger than LEVEL 3. (The power in step S124 corresponds to "LEVEL 4" in FIG. 11.)

When the user 60 is an authenticated user and when, for example, the user 60 has registered a job in advance, power may be supplied only to the devices necessary for the job. The power at LEVEL 4 changes in accordance with the types of

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device and the number of devices to which power is supplied; however, the power at LEVEL 4 is larger than the power at LEVEL 3.

FIGS. 12A to 14F are examples of action patterns according to the flowchart illustrated in FIG. 11. Note that symbols S1 to S4 illustrated in FIGS. 12A to 14F denote steps that correspond to some of the steps in FIG. 11, and “Y” or “N” at the end of each symbol represents YES or NO in the step corresponding to the symbol.

Here, there are relationships between the symbols S1 to S4 and some of the steps in FIG. 11 as follows: the symbols S1, S2, S3, and S4 correspond to steps S100, S106, S114, and S118 in FIG. 11, respectively. FIGS. 12A to 12C illustrate, in the simplest manner, a transition diagram of power supply states of the person presence sensor 28, access camera 29, and recognition camera 30 when the user 60 is approaching the image processing apparatus 10.

In FIG. 12A, power is supplied only to the person presence sensor 28. The user 60 is outside the detection area F of the person presence sensor 28, and the person presence sensor 28 has not yet detected a moving object (NO in step S100 or “S1N”).

FIG. 12B illustrates a state in which the user 60 (drawn with solid lines) enters the detection area F of the person presence sensor 28. At this point in time, the person presence sensor 28 detects a moving object, which is the user 60 (YES in step S100 or “S1Y”). Thus, power is supplied to the access camera 29.

Images of the user 60 are captured by the access camera 29 and the images are analyzed. As a result, when it is predicted that the user 60 is approaching the image processing apparatus 10 (YES in step S106 or “S2Y”), power is supplied to the recognition camera 30.

FIG. 12C illustrates a state in which the user 60 (drawn with solid lines) is facing the UI touch panel 216 (YES in step S114 or “S3Y” and YES in step S118 or “S4Y”). Capturing of an image of a face is executed by using the recognition camera 30.

FIGS. 13A to 13E illustrate a transition diagram of power supply states of the person presence sensor 28, access camera 29, and recognition camera 30 in the case where the user 60 changes its course after entering the detection area F of the person presence sensor 28.

FIG. 13A is the same as FIG. 12A, and FIG. 13B is the same as FIG. 12B.

FIG. 13C illustrates a state in which the user 60 (drawn with solid lines) has approached the image processing apparatus 10 once after entering the detection area F of the person presence sensor 28 (YES in step S106 or “S2Y”), but later changes its course and is not moving toward the image processing apparatus 10 (NO in step S114 or “S3N”).

However, FIG. 11D illustrates a state in which the user 60 (drawn with solid lines) has changed its course again (YES in step S114 or “S3Y”) and is facing the UI touch panel 216 and power is supplied to the recognition camera 30 (YES in step S118 or “S4Y”).

In contrast, FIG. 13E illustrates a state that continues from the state illustrated in FIG. 13C. FIG. 13E illustrates a state in which the user 60 (drawn with solid lines) has left the detection area F of the person presence sensor 28 and power supply to the access camera 29 is shut off (NO in step S106 or “S2N”).

FIGS. 14A to 14F illustrate various actions of the user 60, including the ones illustrated in FIGS. 12A to 13E.

FIG. 14A is the same as FIG. 12A, and FIG. 14B is the same as FIG. 12B.

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FIG. 14C illustrates a state in which the user 60 (drawn with solid lines) has approached the image processing apparatus 10 after being detected by the person presence sensor 28 (YES in step S114 or “S3Y”) but power is not supplied to the recognition camera 30 because the user 60 has moved toward a position different from the position at which the user 60 faces the UI touch panel 216 (NO in step S118 or “S4N”). In this case, the user 60 may leave the detection area F of the person presence sensor 28.

Here, when the user 60 stops moving, the person presence sensor 28 does not detect the user 60; however, the access camera 29 may still recognize presence of the user 60. Furthermore, even when the user 60 (drawn with solid lines) moves to the left on the sheet in FIG. 14C and leaves the detection area F of the person presence sensor 28, the access camera 29 may recognize presence of the user 60 in the detection area R.

FIG. 14D illustrates a state in which the user 60 (drawn with solid lines) has moved from the position illustrated in FIG. 14C and is facing the UI touch panel 216 (YES in step S118 or “S4Y”).

FIG. 14E illustrate a state in which the user 60 (drawn with solid lines) has moved from the position illustrated in FIG. 14C and has left the detection area F of the person presence sensor 28 (NO in step S114 or “S3N” and then NO in step S106 or “S2N”).

FIG. 14F illustrates a state in which the user 60 (drawn with solid lines) has moved from the position illustrated in FIG. 14C, has left the detection area F of the person presence sensor 28 as illustrated in FIG. 14E, and then has made a U-turn and is facing the UI touch panel 216 (YES in step S106 or “S2Y”, YES in step S114 or “S3Y”, and then YES in step S118 or “S4Y”).

Note that the action patterns illustrated in FIG. 12A to 14F are just examples. The power supply control performed in such a manner that the person presence sensor 28, the access camera 29, and the recognition camera 30 cooperate with each other is not limited to the action patterns illustrated in FIG. 12A to 14F and may be applied to various action patterns of a moving object. Moreover, the power supply control may also be performed in a case where, in addition to the user 60 illustrated in FIG. 12A to 14F, there is a moving object that passes near the user 60 or plural users are approaching the image processing apparatus 10 simultaneously.

In the present exemplary embodiment, the detection area F of the person presence sensor 28, the detection area R of the access camera 29, and the detection area La of the recognition camera 30 are used for the image processing apparatus 10. In the case where a moving object (the user 60) is approaching the image processing apparatus 10 while the image processing apparatus 10 is in the sleep mode, the person presence sensor 28, the access camera 29, and the recognition camera 30 cooperate with each other. As a result, before the user 60 faces the UI touch panel 216 of the image processing apparatus 10, devices of the image processing apparatus 10 that are necessary for operation receive power and are made to be in a state in which the necessary devices are ready for operation (that is, the image processing apparatus 10 is in the standby mode) with minimum power supply.

The detection area R of the access camera 29 is broader than the detection area F of the person presence sensor 28. Thus, even when a moving object (the user 60) moves into the dead-angle area of the person presence sensor 28 after the person presence sensor 28 detects the user 60, the movement of the user 60 may be recognized assuredly (for example, the direction in which the user 60 is moving may be predicted).



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The present exemplary embodiment includes the following examples.

## EXAMPLE 1

Central control is performed by the main controller **200** for devices such as the image forming unit **240**, the image reading unit **238**, the facsimile communication control circuit **236**, the UI touch panel **216**, and the like. The image processing apparatus **10** has a partial power saving function through which devices that are not being used and the main controller **200** are individually made to enter a sleep state.

## EXAMPLE 2

Instead of a pyroelectric type sensor, which is used as the first sensor **28**, a two-dimensional arrangement heat-source detector or a reflection type detector may be used. The two-dimensional arrangement heat-source detector is given pixelated configuration by two-dimensionally arranging plural heat-source detection elements that output an electric signal based on at least heat quantity received from a heat source. The reflection type detector detects whether there is a moving object in a detection area. Moreover, plural different types of sensors may be used together.

## EXAMPLE 3

The following analysis techniques (a) to (c) may be used as techniques to realize the function of the access camera **29**.

(a) Distance to the user is determined in accordance with a change in the area of a detected person.

(b) Even when a captured image is a still image, a face of a person is specified in the still image and the direction in which the person is moving (the vector) is predicted in accordance with the orientation of the face.

(c) When capturing of images is performed at plural different locations, differences in position coordinates are analyzed.

Note that, in the present exemplary embodiment, the image processing apparatuses **10** are used as targets for which power supply control is performed. However, targets are not limited to the image processing apparatuses **10**. Processing apparatuses for which power supply control is executed in accordance with the type of moving object (a user or a non-user), predicted movement of a moving object, and a movement history of the moving object may also be targets of the present exemplary embodiment. Examples of such processing apparatuses are vending machines, security systems for buildings, ticket vending machines, automatic ticket gates, and the like.

In this case, there may be a case in which a person recognition apparatus described below is necessary. The person recognition apparatus includes a detector that detects a moving object, a first image capturing unit that captures a specific-area image of a specific area including a predicted course of the moving object at the time when the detector detects the moving object, a second image capturing unit to which power is supplied in the case where it is confirmed that the moving object is approaching the person recognition apparatus in accordance with information of the specific-area image captured by the first image capturing unit and that captures a characteristic image of the moving object, and an identity recognition unit that performs identity recognition in accordance with information of the characteristic image captured by the second image capturing unit.

Note that, in the present exemplary embodiment, "face authentication" is considered to be a result of "face recogni-

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tion". That is, the "face recognition" is not limited to the "face authentication". For example, performing of the "face recognition" includes a service in which a facial expression (for example, smile or wink) is recognized and a message or the like that is appropriate for the facial expression is displayed on an image displayed on the UI touch panel **216**. Moreover, in face recognition, speech may be analyzed by recognizing movement of lips.

The foregoing description of the exemplary embodiment of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiment was chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

1. A power supply control apparatus for a printing device, the power supply control apparatus comprising:
  - a transition unit configured to make an apparatus that includes processing units enter a power supply state or a power shutoff state, power being selectively supplied to the processing units in the power supply state;
  - a detector configured to detect a moving object while the apparatus is in the power shutoff state;
  - a first image capturing unit that includes a sensor with a camera function, the first image capturing unit being configured to capture images of a specific area at a time when the detector detects the moving object;
  - a command unit configured to command the transition unit to make the apparatus enter the power supply state in a case where it is determined that the moving object is approaching the apparatus in accordance with image information of the images captured by the first image capturing unit, and to command the transition unit to make the apparatus exit the power supply state in a case where it is determined that the moving object is not approaching the apparatus in accordance with image information of the images captured by the first image capturing unit;
  - a second image capturing unit configured to capture a characteristic image of the moving object that is approaching the apparatus; and
  - an identity recognition unit configured to perform identity recognition for the moving object in accordance with image information of the characteristic image captured by the second image capturing unit.
2. The power system control apparatus according to claim 1, wherein, in response to the detector detecting movement of the moving object in a predetermined detection area, power is supplied to the first image capturing unit.
3. The power supply control apparatus according to claim 1, wherein, in response the first image capturing unit detecting that the moving object is approaching, power is supplied to the second image capturing unit.
4. A printing device comprising:
  - a power supply controller configured to individually make apparatuses enter a power supply state or a power shutoff state, the apparatuses including:
    - a processing section configured to execute specific processing upon receiving power,

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an interface section configured to receive operation command information for the processing section and transmit state information regarding the processing section; and

a management controller configured to manages the processing section and the interface section in such a manner that operation of the processing section cooperates with operation of the interface section;

a detector to which power supply is continued by the power supply controller even in a case where all the apparatuses are made to enter the power shutoff state by the power supply controller, that the detector being configured to detect movement of a moving object in a predetermined detection area;

a determination unit that includes a first image capturing section, the first image capturing section including a sensor with a camera function and being included in the apparatuses, the first image capturing section being configured to capture images of a specific area upon receiving power that starts to be supplied at a time when the detector detects that a moving object has entered the detection area, to determine whether or not the moving object is a user who is approaching the processing section or the interface section in accordance with image information of the images captured by the first image capturing section, and to cause, in response to determining that the moving object is a user who is not approaching the processing section or the interface section, the first image capturing section to stop receiving power;

an identity recognition unit that includes a second image capturing section, the second image capturing section being configured to capture a characteristic image of the moving object upon receiving power that starts to be supplied at a time when it is determined by the determination unit that the moving object is a user who is approaching the processing section or the interface section, and to perform identity recognition for the user in accordance with image information of the characteristic image captured by the second image capturing section; and

a specification unit configured to specify a management control manner for operation of at least the interface section in accordance with a result of the identity recognition performed by the identity recognition unit, the management controller being configured to perform management control in the management control manner.

5. A non-transitory computer readable medium storing a program causing a computer to execute a process for controlling power supplied to a printing device, the process comprising:

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capturing images of a specific area, by using a first image capturing unit that includes a sensor with a camera function, at a time when a moving object is detected in a case where a system that includes processing units is in a power shutoff state, power being selectively supplied to the processing units when the system is in a power supply state;

making the system enter the power supply state in a case where it is determined, in accordance with image information of the captured images of the specific area, that the moving object is approaching the system;

making the system exit the power supply state in a case where it is determined, in accordance with image information of the captured images of the specific area, that the moving object is not approaching the system;

capturing a characteristic image of the moving object that is approaching the system, by using a second image capturing unit; and

executing an identity recognition function in accordance with image information of the captured characteristic image.

6. A power supply control method for a printing device, the power supply control method comprising:

making a control target that includes processing units enter a power supply state or a power shutoff state, power being selectively supplied to the processing units in the power supply state;

detecting a moving object by using a detector while the system is in the power shutoff state;

capturing images of a specific area, by using a first image capturing unit that includes a sensor with a camera function, at a time when the detector detects the moving object;

making the system enter the power supply state in a case where it is determined that the moving object is approaching the system in accordance with image information of the images captured by the first image capturing unit;

making the system exit the power supply state in a case where it is determined, in accordance with image information of the captured images of the specific area, that the moving object is not approaching the system;

capturing a characteristic image of the moving object that is approaching the system, by using a second image capturing unit; and

performing identity recognition for the moving object in accordance with image information of the characteristic image captured by the second image capturing unit.

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